E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; 7(10): 418-421
Received: 20-07-2024
Accepted: 25-08-2024

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Liquid organic manures in boosting plant health and yield: A review

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i10f.1782

Abstract
Liquid organic manures (LOMs) play an important role along with other organic inputs for maintaining soil productivity under organic management. LOMs are aqueous products prepared from the plant or animal derivatives mainly used as plant nutrient sources. These are locally available, easily preparable, less expensive, eco-friendly biodegradable and nonhazardous products. Commonly used LOMs are cow urine, cow-dung slurry, panchagavya, jeevemrutha, dasagavya, vermi wash, compost tea, green leaf extract, fish amino acid *etc.* In addition to their nutrients status, LOMs also contain plant growth promoting hormones like IAA and GA, beneficial microorganisms like N_2 fixers, phosphate solubilizing bacteria and enzymes. They play a vital role in enhancing crop productivity with sustaining the soil health. In addition to this, the pesticidal nature of the LOMs also resists the insect and disease infestation in the plant. Thereby, the use of LOMs supports the farmers with sustainable yield production. Volatilization of NH_3 is one of the main constraints when LOMs are used as foliar spray. This can be minimized by applying them early in the morning or late afternoon. Though, the collection and transportation of raw materials are tedious, the preparation of LOMs can be made easy by effective utilization of available on farm sources

Keywords: Liquid organic manures, organic farming, soil fertility, sustainability and on-farm resources.

Introduction
The rising global population is placing significant pressure on agriculture to provide sufficient nutritional food for everyone. To meet the current demand, farmers have been increasingly using chemical fertilizers to boost productivity. However, the overuse of these fertilizers has reached its limit in terms of effectiveness and has led to declining soil fertility and the accumulation of harmful substances in harvested crops. Furthermore, the rising cost of inorganic fertilizers is becoming unaffordable for small and marginal farmers. Therefore, it is crucial to find alternative solutions that are both cost-effective and environmentally friendly to replace chemical fertilizers. Organic production and crop diversity take precedence with emphasis on increasing soil carbon to mitigate climate change. Organic farming, with holistic nutrient management, is considered as the best option for sustaining soil health. Organic nutrient management involving the addition of manures and soil amendments provides an additional benefit by modifying the physical properties of the soil [1]. Though the yield from organic farms is less than that of the conventional farm during initial years, the premium price for the product may compensate the extra cost for organic farming.

In organic farming, both organic and liquid organic manures are essential for promoting sustainable agriculture by enhancing soil health, plant growth, and environmental stewardship. Organic manures provide a gradual release of essential nutrients to crops, ensuring a consistent and sustained supply over time. While, liquid organic manures (LOMs), derived from plant or animal sources, offer a fast-acting nutrient solution that is easily absorbed by plants, enabling rapid correction of deficiencies and promoting healthy growth. Recently, use of liquid organic manures is becoming popular among the farmers due to their beneficial effects on soil and crop. These liquid manures are compatible with existing irrigation systems, facilitating even and targeted nutrient distribution across fields while saving time and labor. Their filtration and processing help prevent the introduction of pathogens and weed seeds, ensuring the safe delivery of nutrients to crops. Moreover, the ability to tailor nutrient formulations based on specific crop

needs and growth stages optimizes yields and overall plant health.

Liquid organic manures also improve soil structure and moisture retention, fostering a healthy soil microbiome and supporting long-term sustainability. Additionally, their reduced storage requirements compared to solid manures make them a practical and efficient choice for farmers. Overall, liquid organic manures enhance farming operations and contribute to optimal crop nourishment. Liquid organic manures (LOMs) are a valuable component in providing plants with the necessary nutrients in precise quantities as needed. These aqueous products, derived from plant or animal sources, serve as accessible, cost-effective, eco-friendly, and biodegradable nutrient sources for crops. Common examples of LOMs include cow urine, cow-dung slurry, panchagavya, jeevamrutha, dasagavya, vermiwash, compost tea, green leaf extract, fish amino acid, and biodigester slurry. By offering an immediate supply of nutrients and supporting soil health, LOMs play a crucial role in enhancing crop productivity and fostering sustainable agriculture.Features of liquid organic manures. The important characters of LOMs include that they are applied as foliar spray in lower concentrations, absorbed by plants twenty times faster than organic manures and contain essential macro and micronutrients, plant growth hormones, beneficial microorganisms, and enzymes, while also offering some pest and disease resistance.

Advantages of liquid organic manures

Soil incorporation of liquid organic manures (LOMs), including cow dung slurry, panchagavya, jeevamrutha, and biodigester slurry, enriches the soil with organic matter and nutrients, enhancing its physical and chemical properties such as texture, structure, water holding capacity, pH, and nutrient content. These manures provide organic carbon for soil microbes and contain beneficial microorganisms that facilitate nutrient mineralization and translocation. This, in turn, boosts plant nutrient status, promoting faster nutrient uptake and increased crop productivity [2]. Certain LOMs form a thin oily layer on leaves, reducing transpiration and aiding drought tolerance, while fulvic acid enhances plant resistance. LOMs also offer pest and disease resistance, are cost-effective due to on-farm resources, and improve crop growth and yield by supplying essential nutrients and plant growth hormones.

Preparation and applications of liquid organic manures

Cow urine: Cow urine is a significant liquid organic manure rich in nutrients such as nitrogen, potassium, and calcium, as well as beneficial enzymes like dehydrogenase, alkaline phosphatase, and acid phosphatase. It can be directly collected from cows and diluted to the recommended concentration for use. Cow urine also serves as a natural pest repellent; its application has been found to reduce pest damage in brinjal [3].

Cowdung-urine extract: Cowdung-urine slurry is a traditional liquid manure used for centuries, consisting of a blend of cow dung and urine in an equal proportion, mixed with an equal amount of water. This mixture is a nutrient-rich source with beneficial microbes and is mainly used as a soil application. To prepare the slurry, mix the cow dung, urine, and water in equal parts and allow the mixture to ferment for five days, stirring occasionally. On the sixth day, filter the mixture through a gunny bag or mesh to remove larger particles and then through muslin cloth for a clearer solution. Add 150 grams of lime to the filtered solution and mix well. The prepared extract should be diluted with 100 liters of water before application. Filtering is essential when using the slurry for foliar spray to prevent sprayer clogging, but it can be skipped for soil application. For soil application, the recommended dosage is 500-1000 liters per hectare, while for foliar spray, use a 1-2% concentration [4]. Soil application of cow dung-urine slurry @ 5 t ha^{-1} significantly increased the individual fruit weight of water melon which in turn resulted in higher yield [5].

Panchagavya: The term "gavya" is associated with cows, and panchagavya comprises five main cow-derived ingredients: dung, urine, milk, curd, and ghee. Desi cows are preferred due to their higher levels of nutrients, enzymes, and microbial load. Panchagavya can be used as a growth promoter for enhancing crop growth, yield, and quality through various applications, including foliar spraying at 3%, seed treatment at 30%, and soil application at 500 liters per hectare. To prepare panchagavya, mix cow dung (7 kg) and ghee (1 kg) on the first day. On the third day, add cow urine and water (10 liters each). On the 15th day, incorporate the remaining ingredients: milk (3 liters), curd (2 liters), tender coconut water (3 liters), jaggery (3 kg), and 12 bananas. After 21 days, the panchagavya is ready for use and can be stored for up to six months (KAU, 2009). Foliar application of panchagavya at 3% combined with soil application of enriched bio-digested liquid manure improved soil nutrient status in a groundnut-onion cropping system [6] while, foliar application of panchagavya and cow urine (each at 5%) reduced fusarium wilt, stem rot, and root rot severity in bell pepper [7].

Jeevamrutha: Jeevamrutha is another liquid organic manure prepared from cow dung, urine, green gram flour and tender coconut water. It was introduced by Subhash Palekar who is a well-known farmer in natural farming. His preparation method includes mixing of all the ingredients *viz*., cow dung (10 kg), urine (10 L), green gram flour (2 kg), undisturbed soil (500 g) and tender coconut water (2 L) in 200 L water. It is kept for fermentation and can be used after two days. The product will be stirred occasionally thrice in a day to enhance the microbial activity [8]. Jeevamrutha is also most commonly used due to their nutrient and microbial status. Jeevamrutha can be used @ 3% as a foliar spray and @ 500 l ha^{-1} for soil application. Mulching is to be done if it is applied in the soil.

Dasagavya: It is a natural agricultural solution that combines panchagavya with green leaf extracts from specific plants. The plants used depend on the region: in temperate areas, species like *Artemisia nilagirica*, *Leucas aspera*, *Lantana camara*, *Datura metel*, and *Phytolacca dodecandra* are used, while in tropical areas, recommended plants include neem (*Azadirachta indica*), erukam (*Calotropis gigantea*), kolingi (*Tephrosia purpurea*), notchi (*Vitex negundo*), umathai (*Datura metel*), katamanaku (*Jatropha curcas*), adathoda (*Justicia adhatoda*), and pungam (*Millettia pinnata*). The leaf extracts are prepared by soaking chopped leaves in cow urine in a 1:1 ratio (1 kg of leaves per 1 liter of cow urine) for ten days. The filtered extracts are then combined with the panchagavya solution. Dasagavya can be used as a foliar spray at a 3% concentration, enhancing seed germination and root development when seeds are soaked or roots are dipped in the solution for 20 minutes before planting. During the crop growth period, weekly spraying with dasagavya can boost growth, yield, and quality while also

offering protection against pests such as aphids, thrips, mites, and diseases like leaf spot, leaf blight, and powdery mildew.

Vermiwash: Vermiwash is a liquid byproduct of vermicomposting that is collected from a vermicomposting unit and from the body wash of earthworms. This extract is rich in plant nutrients, beneficial microbes, and enzymes that promote plant growth. Vermiwash can be applied in various ways, such as foliar spray, soil application, or seed/seedling treatment, at concentrations of 3%, 500 liters per hectare, and 3% respectively, to enhance plant biomass production. Additionally, vermiwash possesses pest-repellent and disease-controlling properties. To prepare vermiwash, the unit should be located at a higher elevation above ground level for easy collection of the extract. The base of the unit consists of pebbles and coarse sand layers that aid in filtering and purifying the wash. A thin layer of cow dung is spread over the sand to speed up decomposition. A continuous water supply is provided at the top of the unit, facilitating the frequent collection of wash and maintaining consistent moisture levels throughout the system. Coconut leaf vermiwash @ 1:20 dilution as foliar spray boosted microbial population in cowpea rhizosphere [9]; 2% foliar spray increased fenugreek yield [10].

Green leaf extract: It is a fermented liquid extract of leaves which supplies nutrients as well as control the pests. Green leaf extract can be prepared by dipping 2 kg each of the leaves of glyricidia, chromolaena, neem, datura and lantana in 200 l of water for 10 days. The extract can be filtered, diluted for ten times and applied. Applying water hyacinth liquid manure as a foliar spray, combined with poultry manure in a pumpkin field, significantly enhanced growth parameters such as vine length, number of branches, number of leaves, and shoot dry weight. This supplementation with plant nutrients from water hyacinth extract led to increased plant growth and development [11]. Additionally, foliar application of fermented plant extract along with soil-applied farmyard manure, vermicompost, and poultry manure improved fruit quality parameters of okra, including vitamin C, crude protein, and carotene content [12].

Compost tea: Compost tea, an aerobically fermented liquid derived from compost, is nutrient-rich. When prepared from groundnut cake, neem cake, and poultry manure, it enhances the vitamin C content in amaranthus [13]. Foliar application of compost tea in an apple field improved soil organic carbon and increased nitrogen content. It also enhanced apple quality parameters such as glucose, Fvitamin C, and calcium content.

Fish amino acid: Fish amino acid is a liquid extract produced by fermenting fish by-products (bones, head, and skin) with jaggery. It is rich in amino acids and nutrients, serving as a nitrogen source for plants. Applied as a light foliar mist or soil drench, fish amino acid maximizes nutrient uptake and minimizes leaching, supporting plant health [14]. Foliar application of fish amino acid boosts yield, fragrance, and taste in vegetables [15]. The mixture of fresh fish waste and jaggery is fermented in a sealed plastic or earthen container to create an anaerobic environment [16]. The fully fermented product has a sweet taste and slight fishy odor. Using fish amino acid as a foliar spray with poultry manure in soil enhances cucumber shelf life due to improved fruit quality [17]. Foliar application also increases the overall acceptability of oriental pickling melon [18].
Egg amino acid: Egg amino acid, also known as "egg lime formulation" or "Muttai Rasam," is a plant growth hormone developed by progressive farmer Mr. Gopalakrishnan in Tamil Nadu. The formulation is made by fermenting eggs with lime juice and jaggery. To prepare egg amino acid, 10-15 eggs with shells are placed in a container, and enough lime juice (20-25 limes) is added to cover the eggs. After 10 days, the eggs become rubbery. At this point, 250 grams of jaggery are added, and the mixture is left to ferment for an additional 10 days. The resulting egg amino acid can be applied as a foliar spray at a concentration of 2 ml per liter of water [19]. This formulation promotes tremendous growth and yield in crops. The combining egg lime extract and panchagavya (40 ml each in 940 ml water) significantly improved tomato growth, including plant height, leaf count, leaf area, and chlorophyll content [20]. The combined foliar application of jeevaamrutha, panchagavya, fish amino acid and green leaf extract significantly increased the rice equqivalent yield, system productivity and sustainable yield index of rice based cropping systems under organic management [21]. Further, their combined usage also improved the soil physicochemical and biological properties [22]. The seeds treated with liquid organic manures performed better germination rate, length of plumule and radicle, dry weight, fresh weight and vigour index under oriental pickling melon [23].

Other preparations

Liquid egg shell extract: The fermented product of eggshells can be made by fermenting a mixture of eggshells, vinegar, and water for two weeks. This mixture can be applied as a foliar spray [19].

Arappu-butter milk solution: Arappu (*Albizia amara*) is a medicinal plant known for its pest-repellent properties. Its leaf powder can be fermented with buttermilk to create an effective foliar spray. To prepare the mixture, combine 5 liters of buttermilk, 1 liter of tender coconut water, 1-2 kg of arappu leaf powder, and 500 g of waste fruit juice. Allow the mixture to ferment. Once ready, dilute the fermented product 10 times and apply as a foliar spray. This spray acts as a plant growth promoter, insect repellent, and antifungal agent [19].

Amudham solution: Amudham solution is a mixture of cow dung and urine, prepared by combining 1 liter of cow urine, 1 kg of dung, and a solution of 205 g of jaggery in 10 liters of water. The mixture is fermented for 24 hours and can be applied as a foliar spray at a 10% concentration [19].

Coconut-buttermilk solution: This solution acts as a growth promoter due to kinetin from coconut water, which stimulates cell division and elongation. To prepare the solution, collect 1 liter of coconut water and mix it with 5 liters of buttermilk in a vessel. Ferment the mixture for seven days, then dilute it 20 times and apply as a spray. It can also be used for fertigation at a rate of 5-10 liters per acre [19].

Precautions to be taken while spraying liquid organic manures

Most of the nitrogen in Liquid Organic Manures (LOMs) is in the form of ammonia, which is prone to volatilization losses. Volatilization is influenced by the percentage of ammonia, weather conditions, application surface, and timing. To minimize losses due to high temperatures, apply LOMs early in the morning or late afternoon. Incorporating LOMs into the soil can also reduce volatilization, improving their efficiency [24]. LOMs should be stored in shaded areas to prevent losses and kept away from children and animals. Additionally, they must be

used in optimal quantities to avoid plant damage. However, LOMs have some drawbacks, including lower nutrient content compared to other organic manures, the need for extra labor in preparation, difficulty in collecting and transporting raw materials, and an unpleasant odor. Some vegetarians may also object to using products like fish amino acid and egg amino acid.

Conclusion

Liquid organic manures (LOMs) are excellent for supplementing plant nutrients, enhancing plant growth and development. Among LOMs, panchagavya, vermiwash, and fish amino acid stand out for their nutritional value and their ability to repel pests and control diseases. Farmers and self-help groups can produce LOMs on a commercial scale. Future thrust includes the scientific validation of liquid organic manures including shelf life studies, standardization of dose of liquid organic manures, critical time of application *etc.*

References

1. Nyalemegbe KK, Oteng JW, Darkwa EW, Oti-Boateng C. Comparative study of lowland rice-based cropping systems on the vertisols of the Accra plains of Ghana. Agric Sci Res J. 2011;1(8):172-177.
2. Hiremath R, Usha KE. Productivity and soil health of rice based cropping systems under organic management. I. J. Ecol. 2020;47(11):132-137.
3. Karkar DB, Korat DM, Dabhi MR. Evaluation of cow urine and vermiwash against insect pests of brinjal. Karnataka J Agric Sci. 2014;27(4):528-530.
4. Neelima S, Rao GMVP, Chalam MSV, Grace ADG. Bio-efficacy of ecofriendly products against cotton leafhopper, Amrasca devastans (Dist.). Ann Plant Prot Sci. 2011;19(1):15-19.
5. Hossain MM, Howlader MM, Rahman MH, Khatun MR. Effect of IPNS with cowdung bio-slurry on the performance of watermelon in Ganges tidal floodplain. J Environ Sci Nat Res. 2013;6(2):61-63.
6. Latha HS, Sharanappa. Production potential, nutrient use efficiency and economics of groundnut (*Arachis hypogaea*) - onion (*Allium cepa*) cropping system under organic nutrient management. Indian J Agron. 2014;59(1):59-64.
7. Ashlesha, Paul YS. Antifungal bioefficacy of organic inputs against fungal pathogens of bell pepper. Indian J Res. 2014;3(6). Available from: http://www.worldwidejournals.com/paripex/viewinhtml.php ? [21 May 2016].
8. Natarajan K. Panchagavya: A manual. 2nd ed. Mapusa, Goa: Organic Farming Association of India (OFAI); c2008. p. 56.
9. Gopal M, Gupta A, Palaniswami C, Dhanapal R, Thomas GV. Coconut leaf vermiwash: a bio-liquid from coconut leaf vermicompost for improving the crop production capacities of sogoil. Curr Sci. 2010;98(8):1202-1210.
10. Jadhav KP, Patel DJ. Effect of different levels of vermiwash spray on growth and yield of fenugreek cv. local. Int J Dev Res. 2014;4(8):1547-1549.
11. Oke OF. Vegetative growth, nutrient uptake and yield of pumpkin under liquid organic manures in a tropical agroecosystem. J Agric Vet Sci. 2015;8(12):1-4.
12. Singh A. Validation of farmers' practice of organic manuring in okra. M.Sc (Ag) thesis, Kerala Agricultural University, Thrissur; c2011. p. 93.
13. Pilla AS, Sheela KR. Organic liquid manures as nutrient supplement in amaranthus. Int J Recent Sci Res. 2015;6(6):4788-4790.
14. Weinert E, Miller SA, Ikadu DM, Chang KCS, McGinn JM, Duponte MW. Natural farming: fish amino acid. College of Tropical Agriculture and Human Resources, University of Hawaii, Manoa; c2014. p. 1-3.
15. Pline-Brown MA, Davis J. Fertilizers from the sea: fish emulsion and seaweed extract. Organic Research and Publications, Mountain Horticulture Crops Research and Extension Centre, North Carolina State University. Available from: https://www.ces.ncsu.edu/fletcher/programs/ncorganic-res-c.html [06 Nov. 2016].
16. Hiremath R. Productivity and soil health of rice based cropping systems under organic management. Ph.D. (Agri.) thesis, Kerala Agricultural University, Thrissur, Kerala, India; c2018.
17. Krishnan RV. Nutrient management in organic farming of cucumber (*Cucumis sativus* L.). M.Sc. (Ag) thesis, Kerala Agricultural University, Thrissur; c2014. p. 109.
18. Vemaraju A. Liquid formulations for production of organic oriental pickling melon (*Cucumis melo* var. conomon L.). M.Sc. (Ag) thesis, Kerala Agricultural University, Thrissur; c2014. p. 108.
19. TNAU. Organic farming: Portants; c2009. Available from: http://agritech.tnau.ac.in/org_farm/orgfarm_cropproduction _plantprotection.html [05].
20. Alagesan P. Simple organic liquid manure production technique [on-line]; 2014. Available from: [details missing].
21. Hiremath R, Usha KE. Analysis of diversified rice based cropping systems under organic management. J Pharmac Phytochem. 2019a;8(1):1118-1120.
22. Hiremath R, Usha KE. Effect of different rice based cropping systems on soil health under organic management. J Pharmac Phytochem. 2019b;8(1):1121-1124.
23. Vemaraju A, Usha KE, Hiremath R. Conceptual efficacy study on effect of seed treatment with organic liquid formulations on germination and seedling vigour in oriental pickling melon in Thrissur, Kerala. Pharma Innov J. 2021;10(5):222-225.
24. Lorimor JC. Ammonia losses from broadcast liquid manure [on-line]; c1999. Available from: http://lib.dr.iastate.edu/swinereports_1998/33 [5 June 2016].